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HERRON'S PATENT TRELLIS RAILWAY STRUCTURE.

We are indebted to Mr. Herron for his pamphlet, containing full and well illustrated descriptions of the various modifications of his patent.

Without the voluminous drawings, it would be impossible to give the descriptions from the pamphlet before us, as continual reference is made to the cuts. It will be easy, however, to give our readers, who may not have seen the work, a very fair idea of its merits, by omitting all the details.

Mr. Herron, in the modifications specified, has adopted various expedients, which the experience of engineers has designated as the most suitable means of obtaining a good road. These he has in various ways combined with his patent "Trellis Railway Structure." This trellis, or lattice, precisely resembles that used in the ordinary Town's bridge—placed horizontally upon the ground—and extending beyond the track on both sides, with the rails placed over the lines of intersections. The rails are supported continuously by a stout string piece, and the whole structure is fastened together by suitable pins.

The advantages claimed for this track, are as follows:—First, the great extent of bearing surface. It will be evident that a road, constructed upon this principle, will contain, not only the same bearing surface as an ordinary track, but as much more as is due to the excess of surface of the diagonal timbers over the ordinary transom sills or cross ties.

2d. This extent of surface is not only great, but is distributed in

the most advantageous manner, not only between the rails, but on either side, and thus distributing the effect of any irregularity of support over a large surface and diminishing the consequent weakness.

3d. The two lines of rails in the same track are intimately connected, and in fact constitute one whole piece of work. According to one of the plans proposed, each rail is supported by five intersections of these oblique sills; by another plan, the number of intersections is increased to seven. It must be obvious that the sills, proceeding in both directions from a single rail, are made to unite with three rails on the opposite side, and these again distribute their stress upon other sills in like manner, so that a system of support is obtained by these interlacing timbers, highly complicated in its division, yet simple in construction.

4th. Great simplicity in the structure and facility of repair is claimed as another advantage of this track. The lattice timbers are not notched or morticed upon each other, but are connected by timber pins, driven in pairs, so as to form an angle in the form of the letter V, and thus drawing in opposite directions. Screw bolts are also proposed in some cases, which are so placed as to fasten together the rail, string piece and lattice in one firm bond. By the removal of these, and by driving through the pins or inserting a saw and severing them, any one piece of this apparently complicated construction may be easily withdrawn and replaced.

5th. The author considers as indispensable feature in a good road, the continuous support to the rail, and has very properly incorporated it into all his proposed modifications. The propriety of the continuous bearing is now so generally recognised by engineers, that it would be unnecessary to discuss its merits. The joint of the string piece is judiciously placed beneath the middle of the rail.

6th. In accordance with another well established rule, the rail is permanently fastened to the structure only at the middle, while both ends are free to contract and expand under the influence of temperature, without endangering the solidity of the work. This fastening is made by the bolt before mentioned, or rather by two of them, and from the peculiar nature of the scarfing of the string piece, each of these bolts unites the rail, both of the string pieces and the lattice beneath.

7th. The track thus united, has, with the requisite strength and firmness in all its parts, that due degree of elasticity so proper to

the ease of motion, which saves the wear and tear of machinery, and increases the comfort of the traveller.

It need hardly be said that the whole of this structure is to be packed with ordinary sand ballasting to the bottom of the rail, and a uniform path is thus afforded for the use of horses whenever that may be necessary, while no part of the timber is so exposed as to produce serious consequences if the cars should get off the track.

We believe we have fairly set forth the peculiar advantages possessed by the "Trellis structure" in this enumeration, and if we have alluded to devices not original with Mr. Herron, it is not for the purpose of detracting from his merit, as we do not conceive that originality, obtained in defiance of all experience, is deserving of any thing short of contempt, while on the other hand, by ingenious and original applications of well known principles, the credit of the inventor is greatly increased.

There are, however, beside the structure proper, several contrivances introduced in the plans before us, which deserve a passing notice, although they cannot be fairly represented without many cuts.

One of them is the patent wrought iron chain. This chain is made by cutting a plate of wrought iron with two cuts on either side, down to the base of the rail, over which the two outer ears thus formed are turned so as fairly to embrace the rail, while the central ear on each side, is perforated to receive the fastening. This chain needs no bolt, key, or other fastening, for the rail which is retained in its place by the elastiscity of the iron, which yet allows of a longitudinal movement, from the change of temperature. There are some objections to the use of this chair, which, however, are met by the inventor, and some of them claimed as advantages. The cast iron rail proposed by Mr. H., we cannot regard in so favorable a light as his other contrivances, although the joint which he proposes, is ingenious and useful. One objection to this rail is, is the shortness of the lengths, and although this facilitates the handling of the rail, and permits its being cast vertically, yet we do not consider these as a counterbalance to the disadvantages. It is true, that the ingenious joint proposed by the inventor, is calculated to prevent any serious jolt in passing over it, yet the weight of the passing train being distributed over so short a distance by each rail, cannot fail to injure the structure, while the strength imparted by a long bar of wrought iron is entirely lost. It must be remembered, however, that this forms no part of Mr. Herron's "Trellis Railway Structure," which is adapted to the best form of rails in use—he has merely proposed it, among other modifica-

tions, in which various forms of his other patents are introduced. The economy, however, of the cast iron rail, cannot be doubted.

The account of some of the processes for preserving timber, appended to the pamphlet before us, is so highly interesting, that we shall transcribe it for the benefit of our readers. We are for ourselves, however, by no means satisfied of the superiority of Kyanizing. It certainly is not economical, as it costs from three to four times as much per cubic foot, as the preservative process of Dr. Earle's, which we believe to be quite as effectual, and better adapted to penetrate large timber.

[Communicated.]

REPORT OF THE GRAND JUNCTION RAILWAY, 97 miles, 30th June, 1841.

The whole capital of the road and equipment is stated at £2,282,549, or at $5 per £, $11,412,700.

Receipts and disbursments for each half year since the opening of the road:—

	Receipts.	Disbursements.	Nett receipts.	Halfyearly dividend.
Dec. 31, 1837,	£119,513	£62,078	£57,435	5 per cent.
June 30, 1838,	125,634	72,930	52,704	5 "
Dec. 31, 1838,	178,974	104,541	73,433	6 "
June 30, 1839,	190,511	104,667	85,844	6 "
Dec. 31, 1839,	229,593	118,140	111,453	7 "
June 30, 1840,	210,226	104,908	105,318	7 "
Dec. 31, 1840,	237,037	110,642	126,395	6½ "
June 30, 1841,	212,645	104,935	107,710	5½ "

The proprietors will not fail to bear in mind, that they are on the present occasion, for the first time making a dividend on the total expenditure of the company, and that, out of the receipts of the first, which is always the least productive of the two half years, and that first half moreover during an extraordinary stagnation of trade, not anticipated when they came to the resolution of capitalizing the entire debt of the company.

The revenue of the coaching department was kept down during a portion of the half year just ended, by an unnatural, and therefore temporary competition for Lancashire and London passengers on the part of another company, while the merchandize department is greater than under any previous half year.

The statement of the expenses will be found equally satisfactory, as they amount altogether to 40¼ per cent. on the receipts, though the proportion of goods to passengers, producing those receipts, is much greater than at any previous time.

It is gratifying to the directors to be able to say, that though the

increase caused by the meeting of the Agricultural Society at Liverpool was 50 per cent. on the usual receipts, not a single accident occurred, nor, excepting some little delay from the unusually heavy trains, did any thing happen to cause inconvenience to the public; a circumstance which shows the immense advantages and facilities which railways are capable of affording in emergencies. The directors have not failed to acknowledge and reward the exertions of the different servants of the company, to which these successful results may, in a great measure, be ascribed.

Upon the state of the line of the works which the directors have personally inspected in the last few days, no remark is called for, all being in perfect order.

The directors trust they may feel gratified, on some future day, in bringing the project of a railway connection with Scotland by the Grand Junction, more distinctly before its proprietors for their support; at present their object is only to convey their own very strong opinion, that the Scotch traffic should be secured in a western route.

After speaking of the excellent condition of the railway and its stock, and of his confidence in it as an investment, the chairman said he would call the attention of the next board to two points deserving of mature consideration. The first was the passenger fares. He had observed that on railways where low fares were charged, the passenger traffic was astonishingly greater than where they were high, or even moderate. He would instance the Dublin and Kingston, where the rate was one penny (two cents) per mile for each passenger. He did not think this would apply well for long distances, for little or no difference would be made with respect to those who were regular passengers, and who had to travel. There was no inducement therefore to alter their fares throughout, unless their neighbors west and south would do the same. They ought, however, he thought, to reduce their short fares to a price which would have the effect of inducing the public oftener to use the convenience; the plan of charging the same rate of mileage on long and short passages, he was convinced was, under existing circumstances, wrong.

The other subject was the propriety of making dividends more than twice in each year, which he would strongly recommend. With the exception of goods, railway traffic was a ready money business. They might, without making up any entire statement of accounts, divide £2 10s. or £3 in the interims between the half yearly dividends, etc.—that is, make quarterly dividends.

For the American Railroad Journal and Mechanics' Magazine.

Among the subjects of most interest to the public treated of in the "Sketch of a Railway," recently published at your office, is that of the coal trade, showing that the only available mode heretofore of conducting it, has rendered necessary the demand of prices which have borne hard on consumers, and been most particularly oppressive on the poorer classes of them when they are least able to afford it.

It does seem an anomaly that the home product, which is only 200 miles off, should bear as high or a higher price than the foreign sorts which have to come to us a distance of 3000 miles. The faith in the cheapness of canals is yet too generally and too strongly implanted in our community, to bring them under the suspicion of being in any way the cause of it—nor will this faith be much shaken until by the means of a railway, coal is actually to be bought much under our present high prices.

As a useful record to look back upon at some future day, it may be well to give the present price of Anthracite coal delivered from the boat, which may now be stated at $7½ per ton. Let us then see and record also the items which fill up the margin, between the first cost and that price which would seem to imply large profits somewhere.

Cost at the head of navigation, white ash, per ton, -		$2 00
Freight down the Schuylkill, 108 miles, - -	$1 70	
Toll to the canal, " - - -	90	
Wastage, handling and shipping on the Schuylkill,	67	
Freight round to New York, - - - -	1 40	—4 67
Cost shipped on the Schuylkill, - - -		$6 67

At $2 to the miner at the head of navigation, the profit is but moderate, and the dealers in New York at a cost of $6 67, is certainly not overpaid at $7½ afloat. Those then that make the most profit under this system, are the canal and freighters—the former have maintained a steady charge at the above rate, and have divided 18 per cent. per annum—the latter fluctuate with the demand for coal, and generally absorb all the advantages in a rise of price, neither the miner nor the dealer ever benefitting much thereby.

If, therefore, reform is in any thing wanting, it is in the coal trade, both as regards a reduction of the price and a regularity in the supply, by which our own immediate comforts and the general prosperity of the city would be so favorably affected. An average reduction of $2 per ton on the prices heretofore paid on coal

would be a saving to consumers generally, directly and indirectly, not readily estimated, to effect which but one resource exists, and that is by the railway.

But how small the proportion of persons, who yet believe in its efficiency—and remain to be agreeably disappointed, as they certainly will be, when the test shall be applied by the railway, which has been made the subject of the "Sketch." Meanwhile, however, the Cimerean darkness in which the many are thus found in regard to the immense powers of this improvement, as constructed and managed at this day, is attempted to be made still darker, by statements of the following cast, which appeared about the beginning of June last, on this very subject, in the Philadelphia United States Gazette, by a writer who began by claiming some *little practical* knowledge of canals and railways, and concluded his long essay, as well he might, with the reservation of not pretending to *extraordinary accuracy*. Thus, as to the *groundwork* of his calculations. The expense per annum of running a "*Locomotive and train of* 60 *cars*" on this railway is made by him to be - - - - - - - $24.550

While the actual fact, as proved by results on a dozen roads *inferior to this*, is that it cannot be made to exceed $10,000, or at most - - - 12,000

The repairs to road, maintenance, superintendance, etc., he charges at $186,700 per annum, being at the rate per mile per annum, - - - 2,000

While the actual fact, as can be proved by results on other roads, and competent to *renew the whole superstructure*, is a sum not exceeding per mile per annum, 1,250

But besides this he charges a sum of $80,000 per annum, to cover the wear of the rail per annum, putting the whole cost of the line of 94 miles at $2,000,000!! Now at 80 tons of iron rail per mile for 94 miles it would make 7,500 tons, which at $55 per ton, (the present price delivered in New York being only $45 per ton,) would amount to only $414,000 for the whole line, requiring *at his own rate of wear* of 4 per cent. per annum, only $16,500 per annum, and that without giving any credit for the *old iron*, worth at least one half of the new, an item of set-off, altogether overlooked by this *practical* man. And just as he lays it on to the railway so does he take it off of the canal—the extraordinary repairs to the canal he charges at only $10,000 per annum, on the principle that "water does not wear like the rails of the road," (see freshets of 1839 and 1841,) and he makes the coal boats on the canal deliver

each in the season of eight months 1320 tons of coal, when any of the boatmen would tell him they rarely average over 900 tons.

It needs but to point to these more prominent absurdities of this writer—an elaborate exposition of them cannot be required—and we refer to them as specimens of the crudities by which the public allow themselves to be mystified, merely because they are endorsed as *unanswerable* by those whose interests debar them from knowing any better, and whose sanction by the accident of position, has some influence with those who are unwilling to do their own thinking.

The question with the public at large, is not as to the profitableness of this railway as an investment—what concerns them is, that it is competent to carry coal, as so fully established in the "Sketch," and at prices which will effect the desired reform. These prices have recently been announced by advertisement to be $1½ per ton for the winter, $1 75 for the spring, $2 per ton for the summer, delivered on the Delaware at Philadelphia.

By this route, therefore, the cost of placing coal afloat in New York will be about as follows, say for the white ash sort :—

Cost of mining, say white ash, - - per ton,	$1 00
Mine rent, - - - - - -	30
Toll on lateral road, - - - - -	15
Freight and toll to the Delaware, - - -	2 00
Shipping charges, - - - - -	10
Freight to New York through Delaware and Raritan canal,	80
	$4 35

Making a difference of $2 32 per ton less than the cost at the present moment of placing coal afloat in New York, as shown above, from the Schuylkill region. The principal advantage, therefore, of this railway is, that it will regulate the prices in future by the canal, so that hereafter, *between the two*, the public will be served at steady and moderate rates.

We say "*between the two*," for the reason that we estimate the consumption of 1842, '43, the season when these avenues will be in full competition, at 800 to 1,000,000 of tons of Anthracite, and that with only one track, and the want of other conveniences, which time alone can bring, we do not believe in the competency of the railway *at first* to deliver conveniently over 500,000 tons per annum; and further, that it is much the interest of the railway, and indeed of the whole Schuylkill region, that the remaining 500,000 tons *should be made to pass* the canal, which by the *right co-operation* could be readily effected.

The basis for accomplishing this must be a conformity in the cost of placing the white ash coal afloat in New York by canal and railway, taking $4 35 per ton as made above by the latter for a standard, against which other regions furnishing the same quality of coal, could not long continue to compete. The component parts of that standard as suited to the canal could be adjusted as follows, although they may be here put so low as only to allow the several interests to live:

Cost of coal at the mine, white ash,	$1 00
Mine rent,	30
Freight and toll over lateral roads,	25
Freight down the Schuylkill, 108 miles,	1 00
Toll to the canal,	40
Shipping, charges, etc., and supposing waste on canal saved,	40
Freight to New York from the Schuylkill,	1 00
	$4 35

It must be kept in mind, that *were it necessary*, the railway can carry profitably to itself under $2 per ton, as it has advertised for the winter, when the canal is closed, and that its adherence to that price is only required, as part of a compact, to place the dealer by canal on an equality with the railway, supposing the rates just assumed for the canal to be tenable as a living average.

Details of this character are, however, only to be fairly adjusted by actual experience; but while so many interests call for an arrangement by which these two avenues may be made to co-operate for the general good of the whole, and both to prosper, we yet hope to see one concocted from this rough draft which may have a mutual and durable basis. The preponderance in advantages for trade which the railway, by its general facility of personal intercourse alone, will diffuse throughout this region, must be seen and felt before they can be justly appreciated. Let us now see how the canal will stand at a toll of 40 cents per ton, allowing that the other parts of our plan will hold together.

By tolls, 500,000 tons coal, 40 cents per ton,		$200,000
Water rents,		16,000
Tolls as now through the Union canal, etc.,		95,000
		$311,000
Interest on loans, 2,200,000, $5 50 per cent.,		121,000
Repairs and maintenance per annum,		100,000
		221,000
Dividend on capital, 1,700,000, 5 per cent.,		90,000
		$311,000

This would make the canal a 5 per cent. per annum stock for the present, and if the railway should at the same time divide 10 per cent. or more, considering its additional resources in travel and the mail, etc., it should be rejoiced at, rather than give rise to any envious feeling.

While on the subject of the coal trade, we would only further advert to the readiness with which comparatively *distant* coal regions *talk* of furnishing large supplies of this article, without first finding a consumption for it. Thus the Cumberland mines—Wyoming Valley—Dauphin company, etc.—each have their item of 500,000 tons, ready to send forth when their avenues are clear—forgetting that the Schuylkill region with her *two avenues* of railway and canal, can always flood the markets and *undersell* them for years to-come, even when the consumption shall have reached two millions of tons, the present capacity of the canal being near a million of tons, and that of the railway, with two tracks, illimitable.

It should be remarked, however, that the veins of the *red ash coal* (indispensable for domestic use) are comparatively limited in the Pottsville region, and may ere long become expensive to mine. It would then be desirable to make the large bodies of it in the Swatara or Pine Grove district more available than they now are—the smallness of the Union canal, and the low state of water in it generally, not allowing this coal to be got to market on terms to compete with that from Pottsville. When, therefore, the branch road, contemplated from Reading to Harrisburg, through the Lebanon valley, is opened, the plan should be to connect with it—which will open that district to the Susquehanna at Harrisburg on the one hand, and the Delaware at Philadelphia on the other, but particularly the latter, as the most readily and cheaply reached, for supplying the *great points of consumption* on the eastern seaboard.

If the co-operation we have herein adverted to, between these two parallel avenues in the Schuylkill valley, is as practicable as it certainly is desirable to all interests, immediate and adjacent, the sooner it is so publicly understood the better—and it would, in that case, be well for the parties interested, to proclaim that the rule of conduct they intend mutually to pursue, is that of

To Live and let Live.

New York, September, 1841.

[For the American Railroad Journal and Mechanics' Magazine.]

LAWS OF TRADE.

A writer in a late number of the Railroad Journal requested the Editors to republish an article which appeared in the London "Civil Engineer and Architects' Journal," in reply to a pamphlet by Mr. Ellet, Civil Engineer, on Railway and Canal tolls. The Editors complied, and this singular specimen of trans-Atlantic argument was copied into the last number of their Journal.

It is proposed to examine this essay, and to show that the English author has neither understood Mr. Ellet's system, nor appreciated its object.

First, then—"Mr. Ellet's object," says this writer, "is so to regulate the charge of toll upon a canal or railway, as that every part of the country through which the line passes, near or remote, may derive from the improved mode of conveyance an equal share of trade."

Now this is all fancy. Mr Ellet has no where written any such thing. The idea is in itself preposterous; and the very pamphlet under discussion shows, both by diagrams directly, and by fair inference from its language, that it is impossible to produce such a result, if it were desirable to do so. The trade furnished at every point of the line is assumed by Mr. Ellet to be unequal; and he proposes, as one of the objects of pursuit, to find a method of taxing this unequal trade, so that the greatest revenue may be produced, and that the charge may bear equally upon the property which is subject to taxation; and he contends that these conditions are entirely compatible with each other.

After this definition of Mr. Ellet's object, we have the following comment on his argument—the accuracy of which matches well enough with the precision of the previous assertion. "Now all Mr. Ellet's argument depends upon one little assumption, which he quietly introduces, without remark or explanation, quite unconscious that it contains the grossest fallacy. Mr Ellet takes for granted, that the cost of production is fixed, and on this rests his whole theory of tolls."

With this precious representation of his author, the writer then spins several pages of argument to prove that the cost of production is *not* fixed: that it varies in different countries, and under different circumstances, and shows with remarkable perspicuity, that it is a function of the value of land; that it is affected by rents and wages, and countless influences which, as a political economist, (the correspondent of the English Journal appears to be quite *au fait* in political economy,) have not escaped his penetration.

But, unfortunately, all this variety of learning is wasted—for Mr. Ellet has introduced no such assumption, and his theory depends on no such basis. Our critic in his zeal has mistaken an example for a principle.

Mr. Ellet asserts in many passages that, for a certain class of articles, the cost of production is to be deducted from the market value of the commodity, and that the residue is the greatest sum which the article will bear to be taxed for conveyance; but in no place is it intimated that the cost of production is constant. The cost of production, of this particular class of commodities—be it great or little, constant or variable, and let it depend on what consideration it may—he insists, is to be deducted from the market value, to obtain the limit of the charges which the commodity will bear. But this cost of production may be fixed or changeable, without in the least affecting the correctness of the theory in question. It is true that Mr. Ellet has introduced an example in a pamphlet which he calls "A Popular Exposition," etc., in which it is assumed, for the purpose of comparison, and to exhibit an application of his method in a single instance, that the cost of production is constant. In this case it was essential to his object, to assume something; and the assumption made is a fair and probable one, and the results exhibited are such as we find of constant occurrence on the extensive lines of improvement in this country. But still that example was a particular one, and only rendered general by the excited imagination of our critic.

To pass from this misrepresentation to something original, let us take up the third and last position of this commentator.

After admitting that there *are* some heavy articles of small value of which the expense of production may be said to be fixed, such as "timber," (the very commodity, let it be observed, which is used in Mr. Ellet's example,) "stone," "lime," "coal," "ores," etc., (the very articles named in his pamphlet)—it is added—"It is to such products Mr. Ellet chiefly applies his theory, but he does not confine it to them. He intimates that some other principles come into operation with reference to the more valuable articles of trade. But as I have not seen his observations on that part of his subject, and as it appears so me that his principle, if correct, *must be equally applicable to every branch of trade*, and as I know that it has been so interpreted and applied by many of his readers," etc., —he makes a lumping matter of it, and refutes the theory in the aggregate.

Now, can it be true—the question is put to the common sense of

every reader—can it be true, as is asserted by this writer, that precisely the same principles govern the direction, and the charges that ought to be levied for the heavy trade which is confined to the mere borders of a single canal,—which possesses not sufficient value to be sought by a neighboring or distant competitor—as those which control the charges on commodities which are objects of competition for watchful rivals?

Can the writer be competent to the discussion of this subject, or of *any subject* which taxes thought, who asserts that the charge for toll levied on an article for which there is but one market and no competitor, must be regulated by the same considerations as apply to merchandize brought from the Ohio, and for which the rival works of Pennsylvania, Virginia and New York, and the navigation of the Mississippi, are all striving?

Does the introduction of a competitor introduce no new consideration? Are the same charges levied under a monopoly as under brisk competition?

This writer thinks so, or professes to think so, (for we cannot admit that he has ever reflected at all on any part of his subject)—and because Mr. Ellet discriminates between these two cases he condemns his arguments in a sweeping clause, and in the next line confesses that he has never seen them.

He, it seems, prefers to regulate the tolls as his fathers did before him, in the "natural" way; and we are perfectly satisfied to leave the matter to nature's management in England, if it be her province to take the charge of this business in that country; but in New York and Pennsylvania, where no natural law is recognized, the whole subject comes under the jurisdiction of canal commissioners, and we sincerely wish that they may be governed by principles which are applicable to the condition of this country; and be guided in their action on this subject by the true LAWS OF TRADE.

P.

To the Editors of the American Railroad Journal and Mechanics' Magazine:

GENTLEMEN—A writer in the last number of your Journal quotes the practice on the Irish Grand canal, as authority for deprecating the principles of assessing toll which are advocated by Mr. Ellet in his "Essay on the Laws of Trade." After reading that book attentively, I am not disposed to think that the wages of any line, in Ireland or elsewhere, are sufficient authority for repudiating its principles. And I am very far from thinking that the example quoted by this reviewer, goes, in the slightest degree, to impair confidence in them.

According to this article it would seem that in Ireland, stone and manure are of so little value, that the managers of the Grand canal can charge but 4d. and 6d. for their transportation; which they do charge without reference to distance. "And here," your correspondent pleads, "it is evident there is no room for graduation according to Mr. Ellet's plan."

And if so, I would ask, is there not evidently less room to graduate according to the plan which he defends? If these articles will only leave a maximum charge of 10 cents per ton, they will surely better bear the reduction proposed by Mr. Ellet than the increase contended for by Mr. "C. E. B."

The fact is, the managers of the Irish Grand canal have discovered that it is more profitable not to increase their charges proportionally to the distance on certain articles, than to increase according to the usual practice—and have thus made one decided step towards the tariff which Mr. Ellet recommends for such articles. They take an intermediate position between the proper and the common tariff. They recognise that it is impolitic to increase with the distance in certain cases, and they accordingly stand still—a little more reflection may convince them that it would be still better to retrograde. I approve of the course of these managers in making one step towards what I believe to be the true system; and I hope that they may soon see the propriety of another move in the same direction. The experience of these parties as it is exhibited in their practice, is decidedly in support of the views which Mr. Ellet has advanced.

There is one other remark of this reviewer, which it may be well to notice. It is this—"There are, however, certain articles of which the expense of production cannot differ much, and may be said to be fixed. Such as stone, lime, timber, and perhaps coal, ores, etc."

"In certain cases, then, it would appear that Mr. Ellet's assumption is correct, that the cost of production is fixed or nearly so. But it so happens that in these instances, our author's system of tolls would be altogether impracticable. The commodities are of such little value as to be scarce worth removing, unless at a very small cost, etc."

All this may be true in Great Britain, but I should be sorry to find the directors of the improvements of this country guided by conclusions drawn from such premises. Why, gentlemen, I have now before me the annual report of the commissioners of the canal fund for 1839, where I find set down no less than *six hundred and sixty-*

five thousand two hundred and eighty tons, for the quantity of "timber" shipped on the New York canals for that year; and the round sum of *four millions one hundred and eighty-seven thousand dollars* for its value; and *two hundred and fifty thousand dollars for the toll which it paid into the treasury.* I find also, in the same document, a record of more than *two hundred and twenty thousand tons of stone, lime and clay,* of which the value is estimated at nearly *one million of dollars.* And these are articles which our reviewer deems of such little value as to be scarce worth removing! Now I take issue on this ground—Mr. Ellet's pamphlet relates only to such articles—and in relation to such, this writer admits its correctness; but depreciates its value by depreciating the value of the products to which it is applicable. This, I think, exhibits great unfairness, or a ridiculous ignorance of his subject. RIQUET.

[From Herron's Description of a Patent Trellis Railway Structure.]

ON THE PRESERVATION OF RAILWAY TIMBER FROM DECAY.

The rapid decay of railway timber in our climate, exposed as it is to the sun, rain, air, damp earth and vegetation, has caused much solicitude to be felt on the subject of its preservation; but as yet little has been done in a regular systematic manner, by means of the *certain* process, so fully established in Europe, of mineralising it by means of corrosive sublimate; or, as it is there commonly called "Kyanising," after the name of him who by his address and perseverance succeeded in bringing the neglected process into general use. Wherever experiments have been made on the railways in the northern, southern, or middle States, they are officially reported to have fully confirmed the accounts we have from Europe of the astonishing preservative powers of the Bichloride of Mercury, one of the chemical combinations of common salt and mercury, well known, under the name of corrosive sublimate, as a deadly poison which arrests both animal and vegetable life, forming with their substances a new chemical combination that strongly resists all future change at natural temperatures.

On other railways, desultory efforts have been made at some considerable expense, but strange as it may seem, with the recorded experience of nearly a century against it, and without a single fact in its favor that I am aware of, *lime* has been the substance chiefly employed; lime—the powerful alkaline solvent of both vegetable and animal substances, the active fertilizer of the soil, which rapidly decomposes the dead vegetable while it quickens the growth of the living, not unlike in its action to the gastric juice in the stomachs of animals, and entering itself as a component part of the reproduced vegetables,—employed with the view of stopping decomposition and reproduction, under circumstances and in a proportion most likely to produce both results, according to our observation of natural laws.

There have been hot and cold solutions of lime used, also solutions mixed with salt, and even quick lime.

Feeling desirous that some cheap and effectual process might be discovered, I have endeavored to ascertain on what grounds the use of lime had been recommended, but have been unable to trace it to anything better than a vague popular notion in its favor. Every fact that has come to my knowledge has been decidedly against its use, which accords with inductive reasoning from cause to effect.*

Not so with some of the metallic salts, and another substance found in nature, creosote, which chemistry has separated from its combinations. To the latter, which is known to exist in the peat, is attributed the perfect preservation of the timber so frequently dug from the bogs of Ireland and other countries, bearing evidences of having lain there for ages. And it is now well known that creosote was the substance employed by the ancient Egyptians, more than two thousand years ago, to preserve the bodies of their dead, which, with the wooden cases containing them, have remained perfectly sound, as we see, to the present day.

The modern process for preserving timber, which has obtained such extensive use under the name of "Kyanising," it is conceded, was first proposed for the purpose by the celebrated chemist, Sir Humphrey Davy.

In a treatise on the preservation of timber, published by William Chapman, in 1817, he states that Sir H. Davy had recommended the use of corrosive sublimate, and from his own experiments he gave it a decided preference over every other salt: stating that a less quantity than an ounce to the gallon of water would not answer the purpose. This is equal to one pound of sublimate to 16 gallons of water, and the solution now in general use is 1 pound to 15 gallons.

Chapman also experimented with the sulphates of copper and iron; and Tredgold says recommended boiling the timber in a solution of the sulphate of iron, (green copperas.)†

We have also Dr. Ure's authority, that Sir H. Davy had, several years anterior to 1821, used and recommended to the Admiralty and Navy Board the use of corrosive sublimate; but either from doubts of its efficacy, or more probably from a vague apprehension which

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* Dr. Birkbeck states, that "about the year 1779, Mr. Jackson proposed a very complicated lixivium, in which vegetable bodies were to be immersed to protect them against decay. With total disregard of all chemical principles, he composed a lixivium of the *Muriate of Soda*, [common salt] *Epsom Salts*, *Lime*, *Potash*, *Salt water*, etc. He had an opportunity of trying it on the wood of several frigates and other vessels in the navy; but the result was that those vessels built with wood prepared according to his method were less durable than those which had been ordinarily constructed.

"Shortly afterwards a person named Lewis, attempted to accomplish the preservation of timber from decay by means of lime. The Amethyst frigate was assigned for his experiment; but decay was found to attack the vessel more rapidly than in ordinary cases.

"All are aware, [says Dr. B.] that when the dead among human beings are to be rapidly dissolved or disorganized, *quick lime* is thrown into the pit in which they are deposited, not for the purpose of protecting them from decay, but for the very reverse. Yet this is the substance which, upon various occasions, and perhaps more extensively than any other, has had its preservative powers boasted of by different writers."

† Chapman's work will be found in the Library of Congress, and probably in many other places, as it was on sale in Baltimore about 10 years ago. Tredgold's Carpentry was first published in 1820 or '21, and a second edition in '28; pages 199 and 200 of the latter, treats of the above, and on the use of corrosive sublimate, as recommended by Davy. He also reasons on the use of lime, tar, and other substances in his clear analytical style.

seems to have been entertained, that it might prove deleterious to those using the process, or that the prepared timber would exhale a dangerous atmosphere, its use remained circumscribed.

These groundless fears, as they have proved to be, had the effect of retarding its use, except among anatomists, to whom it was a well known preservative of the most delicate organic tissues and parts, even those most liable to putresence, such as the brain; which this metallic solution hardens in a remarkable manner, and saves from natural decay.*

Although the process was known and had been published in several respectable works, which were widely circulated, ten years or more had elapsed without much, if any considerable use had been made of it for the purpose of preserving timber; and, in fact, it seems to have been in a great measure forgotten, or more probably was deemed unworthy of trial by those who controlled the means of testing its utility, when in 1828, Mr. John H. Kyan proposed to the Admiralty to prepare timber in such a way as should resist dry rot or other decay. He was directed to prepare a 12 inch cube of English oak, which he accordingly did, leaving the sap wood on the four corners. This block was deposited in the fungus pit at Woolwich Dock-yard, where it remained three years, and on re-opening the pit, in July, 1831, it was found to be perfectly sound. This astonished all those who had witnessed the previous action of the pit, as it seems no preparation hitherto tried had been able to preserve timber for a similar period; and, so confident were the officers in charge, of the destructive powers of the pit, that they deemed it unnecessary to place an unprepared specimen of the same timber with it; particularly, as Sir T. B. Martin states, there were other specimens placed in the pit prepared in various ways with which it could be compared. All these pieces were destroyed by decay, and some of them, that appeared to have been coated with lime, were covered with fungi, one of them having a mushroom as large as a hat-crown growing out of it. The man who had charge of the pit produced a register of the experiments that had been made, in corroboration of his statement that he had never before seen timber taken out of the pit sound.

A piece of prepared Canada oak, with an unprepared duplicate, were now placed in the pit, and similar pieces put in the lining of a dock at Woolwich infected with dry rot; but the cube of English oak remained in a loft of the dock-yard for 15 months, when it was returned to the pit. In February, 1833, an inspection was made

* "A solution of corrosive sublimate has been long employed for the preservation of soft anatomical preparations. By this means the corpse of Colonel Moreland was embalmed, in order to be brought from the seat of war to Paris. His features remained unaltered, only his skin was brown, and his body was so hard as to sound like a piece of wood when struck with a hammer.

"In the valuable work upon the dry rot, published by Mr. Knowles, secretary of the committee of Inspectors of the Navy, in 1821, corrosive sublimate is enumerated among the chemical substances which had been prescribed for preventing the dry rot in timber; and it is well known that Sir H. Davy had, several years before that date, used and recommended to the Admiralty and Navy Board corrosive sublimate as an anti-dry-rot application. It has since been extensively employed by a joint-stock company for the same purpose under the title of Kyan's patent."—*Dr. Ure's Dictionary of Arts, Manufactures, and Mines. Article Mercury, Bichloride of, page* 811.

in presence of Mr. Faraday, Mr. Lockhart, and Mr. Farrell, an architect from Dublin, who took specimens; the unprepared pieces showed signs of decay, while the prepared were in the best possible state.

The pit was again opened on the "19th July, 1833, in the presence of Commodore Warren, Mr. Jephson, Mr. Benson, and several other gentlemen. The cube came out of the pit perfectly sound, it was sawn through the middle and split, and proved to be in a perfectly sound state; a certificate was affixed to the block by all the gentlemen present."

The Fungus Pit at Woolwich, had been in use since 1815; and the block of oak in question, it was proved, "had been five years surrounded by decaying matter—by the decaying property of the pit—by the heat generated by that decay—and by the quantity of carbonic acid which always existed in the pit, and escaped in great quantities whenever the doors were opened."

It seems, according to the report of Sir R. Stepping, Surveyor of the Navy, who reported the block sound, that up to the date of his report, (Dec. 20th, 1831,) Mr. Kyan had not explained the means he had made use of to preserve the wood. On the 31st of March, '32, he patented the process; the veil of mystery was withdrawn, and it was then seen that the effects which created such astonishment were produced by the neglected process of Davy.

Mr. Kyan's own statement is that he first applied corrosive sublimate to timber in 1825, and in March, 1828, he brought the subject to the consideration of the Admiralty.

The success attending the process in the hands of individuals, together with the uniformly favorable results which continued to be obtained, in the systematic experiments carried on by the engineer officers at the Royal Arsenal, Woolwich, had drawn public attention to the subject, and tanks for the saturation of timber, etc., were erected in many places.

In April, 1835, the Admiralty appointed a Board of Commissioners to inquire into Mr. Kyan's process for preserving timber; their report, together with the minutes of evidence, were printed by order of the House of Commons, 9th July, '35; from which, and other authentic sources, I select a few passages on the preservation of timber in similar situations to that in railways, which may be interesting to those who have not seen the more full accounts of the result of the experiments.

Sir Robert Smirke was one of the first architects to use the process; he had a couple of posts put up under a dropping eave, and both were exposed to the same actions. After a certain time one decayed; the other still stands. In 1825, he put some English oak paling to a house on Stanmore Hill, which was completely gone in four or five years: he replaced it in the autumn of '32 with *prepared* unseasoned yellow pine, which remains quite sound; some yellow pine paling put up the year before, *unprepared*, began to fail in a year, and is now quite gone.

He thinks it will not supersede the usual time for seasoning timber for *joiner's* work, but timber of large scantlings may be used the

sooner for it. Timber, in his opinion, is not reduced in strength by the process; but cannot say to what extent the mercury penetrates the timber: he thinks, however, that it does penetrate, and stated that of the *tanked* wood he had used at Stanmore, in many instances a large piece of the prepared wood of a foot or more had been cut off from the ends: in other instances it had been morticed quite through, and in some instances a piece had been cut out longitudinally. In each case the interior wood, to the depth of at least three inches from the surface, had been exposed.

Sir Robert Smirke, when examined before the *Committee on Timber Duties*, stated:—"I have applied Kyan's process to yellow Canadian pine, about three years ago, and exposed that wood to the severest tests I could apply, and it remains uninjured, when any other, oak or Baltic wood, would certainly have decayed if exposed to the same trial and not prepared in the same manner.

"I took pieces cut from the same log of yellow pine, from poplar, and from Scotch fir; these I placed first in a cess-pool, into which the waters of the common sewers discharged themselves: they remained there six months; removed from thence and placed in a hot-bed of compost, under a garden frame, they remained there a second a six months: they were afterwards put into a flower-border, placed half out of the ground, and I gave my gardener directions to water them whenever he watered the flowers; they remained there a similar period of six months. I put them afterwards into a cellar where there was some dampness, and the air completely excluded; they remained there a fourth period of six months, and were afterwards put into a very wet cellar. Those pieces of wood which underwent Kyan's process, are in the same state as when I first had them; and all the others, to which the process had not been applied, are more or less rotten, and the poplar is wholly destroyed."

"As another example of the effects of the process, I may mention that about two years ago, in the basement story, of some chambers in the Temple, the wood flooring and wood lining of the walls were entirely decayed, from the dampness of the ground and walls, and to repair it under such circumstances was useless. As I found it extremely difficult to prevent the dampness, I recommended lining the walls and floor with this prepared wood, which was done; and about six weeks ago I took down part of it to examine whether any of the wood was injured, but it was found in as good a state as when first put up.

"This preparation of Mr. Kyan's resists all rot—'I CANNOT ROT IT,' added Sir Robert Smirke."

The following report of Mr. S. Beazley, architect, will show the effectual manner in which the prepared posts and palings of the Regent's Park, London, have been preserved by corrosive sublimate:—

"At the commencement of the year 1836, I surveyed and accurately examined the posts and palings in the Regent's Park, for the purpose of ascertaining the comparative states of those timbers which had been prepared by Kyan's patent, and those which had

not been submitted to the process of solution. In my report of that period I stated that indications of decay were already perceptible in most of the unprepared timbers, both at the bottom of the posts, and in those arris edges and ends of the paling which were placed in or had come at all in contact with the earth, while those timbers which were marked as having passed through the solution were quite free from any such symptoms. I now beg leave to state that I have this day, (March 24, 1838,) after a lapse of two years and a quarter from my previous survey, again accurately examined several of the same posts and paling, digging away the earth from the foundations for that purpose; and find that the symptoms of decay, mentioned in my preceding report as having commenced in the unprepared timber, have so considerably increased as to have rendered the bottom of the posts completely rotten to a depth of from one to two inches, and that in several instances fungi have been the consequences of the decay; while I find the prepared timbers which are in the earth sound and in the same state, with the exception of mere discoloration upon the surface, probably arising from the damp state of the earth at the time of its removal. As a farther proof of the difference existing between the unprepared and the prepared timber, we could cut with the greatest ease large pieces from the former with the spade, without using any force, while it required great exertion to chip off very small pieces from the latter."

In the 1st vol. of the Professional Papers, published by the British Royal Engineers, a very interesting account is given of the experiments made at the Royal Arsenal, Woolwich, on the effect of Kyan's process in preserving various specimens of seasoned and freshly cut green timber, cordage and canvass from rotting. I select the following from page 144.

"2d. Of the pieces of wood partly driven into the ground under the eaves of a building, and exposed to the united action of sun, rain, and damp earth, we all agreed, that all the five pieces of oak, ash, elm, Memel fir, and American fir, 'prepared' with the patent, are quite sound; whilst of the duplicate pieces 'unprepared,' the elm and ash were rotten, and the progress of decay had commenced in three others, the oak being the least affected.

The woods used in the foregoing trials had, previously to being put down, been seasoned two years.

"We then proceeded to examine what you, at Mr. Terry's request, had placed under the same test as the last described woods; it appeared to be the most severe trial, viz:—

"A piece of oak, five feet long, three inches diameter.

"A piece of ash, two feet five inches and a half long, six inches and three-quarters diameter.

"A piece of elm, five feet one inch long, three inches and one-eighth diameter.

"All of which came here quite in a green state, and with the bark and some leaves on them, and after being split down the middle and marked, half of each specimen of wood was returned to be saturated with the patent, and when sent back again the whole were put down 31st March, 1835.

"They were taken up a few days ago to dry, and we find at the end of the year and a half, that the '*prepared*' pieces, even to the preservation of the *bark* and *sap*, are perfectly sound, and the 'unprepared' quite *rotten*."

I should state that the foregoing inspection and report are dated 28th September, 1836; and that the seasoned specimens had then been down *three years*.

The process has been found equally efficacious in the preservation of ship timber, even where it is exposed to the constant saturation and wash of the bilge-water, and external wash of the sea. It has the remarkable and highly beneficial effect of keeping the ship and bilge-water free from the usual prutrescent effluvia so offensive in new ships and probably injurious to the health of those on board.

The first ship built wholly of mineralised timber was the "Samuel Enderby," of 420 tons, built at Cowes, in the Isle of Wight, of seasoned oak, with the exception of some of her upper deck beams, which were felled for the purpose and saturated green, having sap on the corners, which was found to be as hard and sound as the other wood on her return from the South Seas.

This ship was launched in August, 1834, and sailed the following October for the South Sea Fisheries, from which she returned to England in March, 1837.

During her absence she was a great part of the time sailing under the line. The crew, 32 in number, continued unusually healthy; and the ship did not require caulking to the usual extent. The masts, yards, cordage and canvass were also mineralised; but the cordage and canvass of this ship did not realize the expectations that were entertained of it: the captain supposes the solution was too strong, as it seems to have succeeded in several other cases. The proofs of the efficacy of the process as regards timber have been so multiplied as to place it beyond a doubt; and my intended limits, which I have already far exceeded, compel me to pass over much that is interesting in the Reports of Lloyd's Surveyors of Shipping, and from other sources. I must confine myself to a few more brief extracts; the first is from captain Lisle's Report:

"*Timbers.*—As regards the timbers, the ship is perfectly sound in every respect, and shows no symptoms or indications of decay in any part throughout the whole ship; and it is my belief that the timber and plank have shrunk less than any new ship I have witnessed. Being at Cowes, inspecting the ship from the time her keel was laid until she was launched, and the greater part of her deck-beams being made from green timber just felled and afterwards submitted to the process, they are now perfectly sound, and firm as if cut from the most seasoned timber. These facts I consider to be strong evidence in favor of the process; and I am so satisfied myself of its good effect on timber, that I should recommend new ships to be built of timber prepared when quite green, and to let it be quite dry before placing it in the ship."

The owners of the ship, state,—"We feel so well satisfied of the

beneficial effects of the preparation on the timber, that in any cases where we may have occasion either to build or repair our ships, we shall continue to use it, and in like manner for masts; in which particular we think that we have derived considerable benefit from its application."

On the return of this ship a bottle of the bilge-water was sent to Professor Faraday, who states that he found it turbid and saline, but quite sweet in smell, and though carefully examined for mercury could find none in it.

"The ship 'John Palmer' left London, December 13, 1833, on a South Sea whale voyage, and returned on 22nd of April, 1837, being absent three years and four months. Previous to her sailing underwent thorough repair: great part of the timber, masts, bowsprits, sails and cordage were saturated with Kyan's patent. The timber, from what I had observed during the voyage, and at the present time, is in the highest state of preservation We have been most of our time exposed to a tropical sun, and the planks in the sides have not shrunk in the least. The masts are in a high state of preservation, etc."

"I am of opinion that the patent has done everything for the canvass that was expected; it has prevented mildew and rot, though not wear and tear."

The above extracts are taken from Capt. Laurence's statement. It should be remarked that the whole of the ship's ceiling and sleeping berths of the men consisted of this timber. See the reports of Lloyd's Surveyors and other documents relating to her.

The process is stated to have the very important effect of shrinking timber as much in a few hours as a seasoning of years would have done; and of subsequently preventing its warping when exposed to the sun and rain; and, what will be found still more beneficial on railways, of preventing the splitting of the timber, which causes great destruction at present.

Dr. Birkbeck, who was one of the commissioners appointed by the Admiralty to inquire into Kyan's patent, in a lecture delivered before the Society of Arts, Adelphi, exhibited a piece of green larch, such as was to be used for sleepers in the Southampton railway. "When it was put into the solution it had cracked in various radial directions—some of the openings being large enough to admit a penny piece. The wood was now rendered perfectly solid, and a slight alteration in the level showed where the fissures had been."

The *rationale* of the process is as follows:—It has been ascertained that the disorganization, or decay of timber, commences with the putrefactive fermentation of the albuminous and gummy fluids, which soon extends to the starch and saccharine matter, lodged with the former in greater or less quantities in the sap vessels and pores of the timber; and as the alburnum, or sap-wood, contains a much larger proportion of these matters, it is the first part to decay. When once decomposition has commenced, the most solid part of the heart timber—the woody fibre, or lignin—offers but little resistance to the universal decomposition which rapidly fol-

lows when aided by moisture and a slight increase of temperature, of from 70° to 80°. This will not create surprise when it is understood that the lignin itself,—the most solid and insoluble part of wood,—is composed of 50 parts water and 50 of carbon; or, what amounts to the same thing, of oxygen and hydrogen in the same proportions which form water; and that the other component parts contain a still larger proportion of water, so that there is no deficiency of the materials of fermentation in any part of the wood.

Corrosive sublimate in addition to its anti-putrescent qualities, has the property of forming with albumen a compound which is insoluble in water, consisting of calomel and albumen.

When wood is steeped in a solution of corrosive sublimate, this insoluble compound of mercury and albumen forms in the pores and vessels of the wood, retaining with it a considerable portion of free sublimate, which Professor Faraday found to equal to three-fourths of the amount; but that it required the most thorough disintegration of the wood to remove it; and that it was his opinion, it would gradually continue, by a play of affinities, to penetrate the wood while it continued in a moist state: he, therefore, regarded the excess of the sublimate, in the parts near the surface of timber, as a most important condition.

Penetration.—Professor Farady stated before the commissioners, "That he had lately examined a plank cut from the middle of a balk of timber 20 inches square, to see how far the corrosive sublimate had gone in. It was easily found at one inch beneath the surface; and by a very careful examination, at four inches beneath the surface: and the process was to digest part of the wood at the spot in very diluted nitric acid, to evaporate the solution considerably, and then examine it by the voltaic battery; mercury appeared at the negative pole. He could not assure himself of its presence in the middle of the block by any means whatever. This was a piece of pine wood sent him by Mr. Brunell."

The test usually employed is the hydro-sulphuret of ammonia, which turns the prepared wood black.

Dr. Birkbeck states, "The analysis of the result performed by Fourcroy, and subsequent by Berzelius and others, is, that the *bichloride* of mercury has been converted in a *protocholride*. In that form it combined with the albumen, which being no longer soluble, descends in a visible form with the protochloride. In the change the bichloride loses one proportion of its chlorine. Bichloride of mercury consists of 200 parts, or one proportion of mercury, and 72, or two proportions of chlorine. One proportional is separated in this process, leaving the protochloride 200 parts of mercury and 36 of chlorine; that is, one proportional of mercury and one of chlorine; and the albumen, being separated along with the protochloride or calomel, descends."

M. Lassaigne, as quoted by Dr. Dickson in his lecture on the preservation of timber, delivered before the Royal Institute of British Architects, the 26th March, 1838, "calculates the composition of the albuminous precipitate to be 6.67 corrosive sublimate, and 93.33 albumen, or 1 atom of sublimate and 10 atoms of albumen."

Dr. Dickson remarks:—"It is impossible for bichloride of mercury to come in contact with albumen without coagulating it. Bichloride of mercury is thus the established test of the presence of albumen, and so delicate is it that the addition of corrosive sublimate to any solution of albumen will indicate the $\frac{1}{2000}$ part, by causing a flaky appearance of the fluid. On the opposite hand, albumen is the established antidote to poisoning by corrosive sublimate; and, though white of egg is generally preferred, milk, or flour diffused through water, or anything containing albumen, may be employed with success."

It would seem from the foregoing that a very minute quantity of corrosive sublimate would be sufficient in ordinary cases to preserve timber from *decay alone;* but in cases where timber has to be protected against insects, or is half buried in the damp earth, as that in the structure of railways, exposed more or less to the splitting action of the sun, and to the decomposing action of vegetation, I regard the excess of the corrosive sublimate as highly important. I propose, however, that timber for the interior of buildings, much of that used in shipping, and for many other purposes, instead of being steeped for several days in the comparatively strong cold solution of corrosive sublimate, should be boiled for a few hours in a very diluted solution, to which pressure might be added in preparing large pieces.

I should not omit to add, what seems obvious to me, that, to render the process effectual, the *timber should be perfectly sound* at the time it is steeped, otherwise the nature of the albumen will be changed, and the chemical combination cannot take place between the corrosive sublimate and albumen. I am further inclined to think, that the solution will be found to penetrate the wood much more deeply, and to be otherwise more effectual, if the timber be felled in the spring about the time the sap begins to rise, and steeped as soon as possible thereafter, while the fluids are in motion; and I have no doubt but that in this case also a much weaker solution than any now in use would be found effectual.

When timber has been long cut, or is affected in the slightest degree, strong solutions should be used. On some of the English railways a much more rapid and effectual mode of causing the fluid to penetrate the timber, by means of hydraulic pressure, instead of simple saturation, has lately been introduced. It is thus described as in use on the Manchester and Birmingham railway. A cylindrical iron vessel, 30 feet long, and 7 feet in diameter, formed of wrought-iron plates $\frac{5}{8}$ of an inch in thickness, double riveted together, so as to be able to resist a pressure of 250 lbs. on the inch, is filled with the wooden sleepers, as closely packed as it is possible; the solution of corrosive sublime is then forced in by one of Bramah's hydraulic pumps, worked by 6 men to a pressure of 170 lbs. to the inch. By this means the timber is more completely saturated in 10 hours than it would have been in some months on the old system.

As to the strength of the solution, with a view to the expense as in use. The solution used at Somerset House consisted of 224 lbs. of

corrosive sublimate to 1,062 gallons of water, being rather more than 1 lb. of sublimate to 5 gallons of water; which latter are the proportions stated in Mr. Kyan's patent; he has subsequently stipulated in his licenses that the solution shall not be used of less strength than 1 lb. to 15 gallons; which latter are the proportions stated to be in use at the Royal Arsenel at Woolwich,* and that the average quantity of corrosive sublimate used was 1½ lbs. to 50 cubic feet of timber. The corrosive sublimate used at the Arsenal cost 4*s.* per lb., that at Somerset House 3*s.* 7*d.*, exclusively of the patent fee. The Admiralty agreed to pay the builder of the "Linnet" packet, which was the first government vessel built of prepared timber, 30*s.* extra per 100 cubic feet, which is equal to $7 27½; this was the cost with a solution of the strength of 1 lb. of corrosive sublimate to 5 gallons of water, and includes the patent fee, and all extra labor in handling," etc.

I have previously stated that Mr. Kyan obtained a patent in England, bearing date the 31st March, 1832; some years afterwards application for a patent was made in the United States, which was refused, I believe, on the ground chiefly of want of originality. An act of Congress was, however, obtained, dated 31st of May, 1838, authorizing the Commissioner of Patents to issue a patent to Angier March Perkins and John Howard Kyan, which was accordingly issued the 23d June, 1838. This act removes the limitation of time within which the patent should have been applied for after the date of the foreign patent, and leaves it to the judiciary to settle the question of originality of invention.

In presenting this highly important subject to the consideration of the American public, and advocating its use, I have felt it incumbent on me to state such historical facts connected with the subject as were within my knowledge, that Mr. Kyan's claims might be fairly understood.

It is thought by some persons that the increased consumption of mercury would greatly enhance its cost, and that an adequate supply could not be obtained to mineralise the timber of railways. On looking into the subject I am satisfied that after a very little time the reverse would be the case, although there are some unfavorable circumstances at present. Dr. Ure, in his new Dictionary of Arts, Manufactures, and Mines, informs us that the mercury mine of Idria in Friuli, might easily be made to yield 600 tons British per annum; but in order to uphold the price of the metal, the Austrian government has restricted the product to 150 tons.

The rich old mines of Almaden, in Spain, since 1827, have produced 110 tons per annum of mercury; and Dr. Ure says that there is nearly as much more let escape into the atmosphere and lost, to the great injury of health in the workmen and inhabitants, by the old and barbarous practice of aludels, which have experienced no improvement since the time of the Moors; his words are, "I am confident that their product might be nearly doubled, with vast economy of fuel, labor, and human life."

* See the 1st vol. of Professional Papers, published by the Royal Engineers, page 131.

Pliny has recorded two interesting facts:—1st, that the Greeks imported red cinnabar from Almaden 700 years before the Christian era;—and 2d, that Rome, in his time, annually imported 700,000 lbs. from the same mines.

The mercury, as in most other cases, is lodged in a bed of bituminous shale, which is from 14 to 16 yards in thickness, extending from the town of Chillon to Almadenejos; and contains nearly 20 per centum of mercury. Near Almaden are the celebrated mines of Las Cuebas Almadenejos, the product of which was formerly appropriated exclusively to working the gold mines; the present yield is not given.

Those of the Bavarian Rhine provinces yield from 40 to 55 tons per annum.

The Hungarian and Bohemian mines, etc., have averaged from 30 to 40 tons per annum for many years.

The present yield of the above European mines, is, therefore, about 372 tons per annum of metallic mercury; which, according to Dr. Ure, who devised an improved distillatory apparatus for some of the German mines, might by this means alone be nearly doubled.

The mines of Guaneavelica in Peru, explored in 1570, yielded to the year 1800, equal to 53,700 tons. About the beginning of the century the annual product was from 170 to 180 tons. This with the product of other South American mines was employed in working the gold mines. There are also red cinnabar mines in Yunnan China, from which mercury was at one time obtained to work the South American gold mines.

It is stated here by the dealers that the Messrs. Rothchilds have now the sole monopoly of the Spanish and Austrian mines, and that they have, in the last two or three years, advanced the price from 42 or 50 cents per pound to $1 05, its present price. Manufacturing chemists charge 20 cents per pound for converting the metal mercury into corrosive sublimate, furnishing the salt, sulphuric acid and fuel, and returning pound for pound. It may not be generally known, however, that 100 lbs. of metal mercury will make 136 lbs. of corrosive sublimate; so that instead of a charge of $20 per 100 lbs., they actually receive $57 80. Whether this charge is exhorbitant or reasonable, I cannot say.

If we suppose 200 miles of railway track be laid every year in the United States, and that, including turnouts and other timber to equal 10,000 cubic feet per mile, which will require 300 lbs. of corrosive sublimate, the increased demand for mercury will only amount to 20 tons per annum.

It is believed that there are other metallic salts which will have the effect of coagulating the albumen, and thus preserve the timber. Dr. Earle, of this city, has a patent for boiling timber in a solution of the sulphates of copper and iron, which he states, in his publications, to which I beg leave to refer the reader, will have this effect, and only cost from 1½ to 2 cents the cubic foot.

I have previously stated that to the presence of creosote was attributed the perfect preservation of the timber found in the bogs;

it is also in use, in connection with coal tar, for the preservation of timber on some of the English railways; and the following account of some recent experiments made in France with this substance, in connection with a metallic salt, give promise of results that seem likely to prove highly beneficial to railways, as the materials employed are very cheap and may be prepared at any place in our own woods. Indeed, the pyroligneous acid may be made from the tops, limbs, and waste wood, and the charcoal will nearly pay the whole expense.

M. Boucherie's process for preserving Timber by means of the Pyrolignate of Iron.—I am indebted to Professor Frazer for the following sketch of M. Boucherie's plan for the preservation of timber, as detailed in the leading article of the Annales de Chimie, for June, 1840; a full translation of which article will be published in the August and succeeding numbers of the Journal of the Franklin Institute.

The chief aims of M. Bouchrie's process are:—

1st. To protect wood against wet and dry rot.

2d. To increase its hardness.

3d. To preserve and develope its flexibility and elasticity.

4th. To prevent the play which it experiences, and the resulting separation, when after being work up it is exposed to atmospheric changes.

5th. To diminish very much its inflammability and combustibility.

6th. To give to it varied and permanent colors and odors.

The first result which M. Boucherie obtained from his experiments, was the establishment of the fact, that "all the alterations to which wood is subjected arise from the soluble matters which it contains." Having then ascertained the impossibility of separating these soluble matters by mere washing—he turned his attention to such chemical re-agents as would render them insoluble and therefore inert, and found that this change could be effected by all salts which have an insoluble metallic base. Seeking then, among this class of substances for that which should combine most advantageously the strong preservative action with economy—he found these two important conditions best fulfilled by the use of the impure pyrolignate of iron, made by the action of the acid procured from the distillation of wood upon iron filings or any small pieces of that metal.

The advantages of this salt are—1st. It may be procured at a cheap rate. 2d. The oxide of iron forms stable combinations with almost all organic substances. 3d. Its acid, (acetic,) has no corrosive properties and is volatile. 4th. It contains the greatest proportion of creosote which any aqueous liquor can dissolve, and there is now no doubt but that this substance protects all organic matters powerfully against every species of decay.

But the principal difference between M. Boucherie's process, and those of other experimenters upon this subject, consists in the manner in which his preservative liquor is diffused throughout the sub-

stance of the wood. After a variety of experiments in various ways, Mr. B. was led to investigate the natural absorption of growing wood, and came to the following interesting and important result. "If a tree of great height be cut, and its foot plunged, within a reasonable time, into a saline solution, whether week or concentrated, a strong aspiration is exercised by the tree upon the liquid, which thus penetrates its tissue, and finally reaches the extreme height of the trunk and even the terminal leaves—if we are careful to furnish a sufficient supply of the liquid.

Thus in six days, in the month of September, a poplar tree, 92 feet in height and 16 inches in diameter, the foot of which was plunged about 8 inches into pyrolignate of iron, was entirely penetrated by the liquid, of which it absorbed the enormous quantity of 10 cubic feet, (about one-tenth of its cubic capacity). A variety of interesting facts and experiments follow, the most important of which is that in all woods there is a central portion which does not absorb any liquid by this means of penetration, and which will probably resist all other methods of impregnation.

In reference to other qualities, M. Boucherie finds that the hardness of wood prepared in this way is more than doubled, so that the workmen complained much of the difficulty of working it.

In regard to the elasticity of timber, M. Boucherie deduces from his experiments, that

1. The flexibility and elasticity of wood are generally proportionate to the moisture which it contains—that these qualities remain only while this moisture lasts—and that the existence of these qualities is evidence of the presence of moisture even in the driest and oldest woods.

2. That in numerous exceptions it appears to depend upon the constitution of the wood itself, and is probably frequently owing to the presence of alkaline salts in the wood.

Following up these determinations, by causing the wood to absorb a deliquescent salt, he succeeded not only in maintaining its original elasticity, but in developing a degree of pliability which it does not possess when first cut. Thus pieces of pine wood, 2 feet in length, and $\frac{1}{10}$th of an inch in thickness, could be so twisted in the direction of their length as to form a complete helix, or could be bent into three concentric circles without breaking. M. Boucherie at first used chloride of calcium, (muriate of lime,) for this purpose, but now proposes, on account of its greater cheapness, the mother waters of salt marshes, which are chiefly composed of deliquescent chlorides. Wood prepared in this way had not had its elastic properties impaired after being kept 18 months.

In regard to the shrinking and warping of wood, M. Boucherie's experiments led him to the conclusion that these effects, (or such of them as were due only to the drying of the wood,) began to show themselves only at an advanced stage of the drying, and when the wood was about to lose the last third of its moisture, Continuing his experiments he found that these effects were entirely prevented by preserving to the wood this last portion of its moisture, by causing

it to absorb a deliquescent salt—as in the process for preserving the elasticity. For the purpose of testing his results he caused to be prepared tables of considerable size and slight thickness, and found that after a year, while those made of the prepared wood remained unchanged, those made of the timber in its natural state were warped in an extraordinary degree. There are many other observations of great interest both on account of their direct practical value, and from the light which they throw upon vegetable physiology. But these, in reference to the preservation of timber from rotting—the maintenance of its elasticity and the prevention of shrinking and warping, I judged would be of the most importance for your purpose.

I remain yours, etc.

JOHN F. FRAZER.

LOW FARES ON RAILROADS.—It must be evident to all whose attention has at all been directed to the subject, that low fares increase both the travel on and profit of railroads wherever they have been established. Philosophy and experience unite in teaching this truth, and they who do not carry out its principles are far from consulting their best interests. The desire for travel, keeps pace with the facilities of travel; and the great knitting together of mankind in all civil countries, by means of the modern improvements of the steamboat and railroad, is a grand proof of the position that make the means of locomotion easy, both to the body and purse, and you create a travel which will effectually reimburse and greatly outbalance the expenditures. We propose to give a summary of the various statistics on this subject, both in Europe and America; by which it will be seen beyond the shadow of a doubt, that low fares best conduce to the advantage of railroad corporations and the community at large. The railway between Liverpool and Manchester, reduced its fare one half; the next year the passengers increased 200 per cent.

The low fares on the Darlington railroad produced 560,000 tons of freight and 196,000 passengers per annum over and above the estimate of the directors. The dividends of the company were £14 per share of £100, which sold readily at £260. The mere reduction of fare on this road of one cent. per mile, created an increase of over 21,000 passengers in three months. In 1836, the fare on the Edinburg and Dalkeith railway was raised about two thirds of a penny, and resulted in a loss of over 50,000 passengers per annum, besides what should be the natural increase of travel on the road. In 1836, the number of passengers on the Garnkirk and Glasgow railway, was 145,703; in 1837, the fare was raised 33⅓ per cent. and the passengers fell down to 119,460.

In 1835, the fare on the Androssin and Kilwinning railway, was for the six miles, 7d.; the number of passengers 700; in 1836, it was 6d. and the number of passengers rose to 20,000; part, however, of this increase was owing to the cars running four times in-

stead of twice a day as formerly. From January 1st, to August 6th, 1838, at 6d. for the six miles, the passengers numbered 20,818. From January 1st, to August 6th, 1839, at 8d. for the six miles the passengers numbered but 15,525.

On the St. Germain railroad, near Paris, during the months of January, February and March, 1838, there were conveyed at the original fare, 160,542 passengers, for 172,515 francs. During the same months in 1839, at a fare reduced 25 per cent., there were carried 236,889 passengers, giving a reccipt of 189,545 francs, showing that though the fares were reduced one fourth, the amount received increased one tenth.

In Belgium, the experiment of low fares has been most satisfactorily tested. In 1839, according to the official report, the fare on the roads was raised 40 per cent., the receipts immediately depreciated 11 per cent. The Belgium administration established, however, a low rate of fares, averaging from 1 to $1\frac{1}{2}$ cents per mile, and according to the testimonies of Michael Chevalier, and the Chevalier de Gerstner, the reduction of fare increased the receipts even beyond what they were before, so that they absolutely furnish an increase to the State, though the cost of a Belgium road, is double that of an American one.

In the United States we know of no road where such small fare obtains. In some, the old stage rate is kept up; in all, it is too high. What the amount of travel would be if low fares prevailed, is shown by the rush wherever opposition lines are started; as for example, from New York to Albany—from New York to New Haven and to Providence—from Boston to Portland, etc., etc. Competition cannot indeed exist on railroads, because, being expensive monopolies, but one is seldom constructed in a given route. They can therefore put the fare at what rate they will, and sustain it as long as they will; but even this cannot be done with impunity; for though those who travel by necessity may use the road, those who travel for luxury will be deterred from it, by the exhorbitance of the charge, and the road, in the end, is the loser.

Such has been the fact on the Boston and Providence route; and their high fares, caused the building of the Norwich and Worcester road, by which the travel has been divided, and the Norwich road sustained by a handsome profit. When the Worcester company raised their fare 25 per cent., it called back a part of the old line of stages—decreased the travel—produced dissatisfaction among its former friends, and the directors were compelled to recede to their former rate, and the result has been the receipt of a thousand dollars per week more than when the fares were higher.

According to the statements of the Chevalier de Gerstner, the expense of sending a train over the roads of Belgium and America average one dollar a mile, so that a road 200 miles long would cost 200 dollars per train. Taking this as the basis of our calculation, and stating the distance between this and Macon. *via* railroad route, at 193 miles, it follows, that a daily train with 50 passengers, could be transported over the road, at an expense to the company of

$3 86, or two cents a mile per passenger. The fare, however, is five cents a mile, or $9 65 for the whole, giving to the company a profit of $289 50 per train. It is very evident from this, that the fare could be reduced, and that the consequent increase of travel, would increase rather than diminish the receipts, for in this locomotive age it is morally impossible to bring the facilities of travel within the reach of all, without greatly augmenting the number, which avail themselves of its advantages. That which has proved itself true in other countries, will be eminently verified in our own.

We are a moving people, made so by the unrestrained intercourse between the several States, by which we can journey through twenty-six sovereignties, and still be in a common country—circulate about in a thousand channels, and through a thousand towns, without going beyond our own laws, or the protection of our own flag; and find from the Atlantic ocean to the Rocky Mountains, from the chain of Northern Lakes to the Gulf of Mexico, the same language, the same institutions, the same free people. There is no other nation on the globe thus situated; and the spirit of improvement needs but a wise and generous direction, to lead us onward to the consummation of our most patriotic desires.

We have hitherto spoken of the increase of passengers merely; but the same laws apply to freights. The extensive examination made on this subject, by a committee of Parliament, proved to demonstration, that low rates created freights; and the strict research instituted into this matter by the French government confirms the report of the English committee, by the experience of every railroad in France and Belgium. The subject of low fares and low freights, is worthy the consideration of our railroad corporations, particularly in this State, and at this time, when it becomes an object of great importance to secure the trade and communication with the interior. It is proved by actual admeasurement, that from the eastern terminus of the Western and Atlantic railroad in De Kalb county, the route to the Atlantic through the Central railroad, to Savannah, is 19 miles shorter than by Greensboro and Augusta to Charleston. Not only so, but the local advantages of the several links composing what we may term the Savannah and De Kalb chain, are far superior to the other chain running through Augusta, Greensboro and Madison. If, as is probable, Savannah should become the depot of the Royal Mail Packets, we shall then have a continuous line of communication even to the west, with one end resting on the shores of England, and the other almost touching the father of waters, as he rolls onward through his tributary valley.

When the route shall be completed in all its details, it remains but to reduce the present high rates of fare and freight, to draw hither the merchandise and travel of the south-west, and thus effectually check the draining operation of the South Carolina road to Augusta, by which the resources of our State are made to minister to another's welfare, and build up another's strength at the expense of our own.—*Savannah Georgian.*

PARIS, *August* 28, 1841.

Authentic reports have just been issued of the results of Dr. Boucherie's processes for imbuing wood for preservation against all injury from the elements; for coloring, scenting it, etc. They are highly important with regard to cabinet ware, railways, naval architecture, and every kind of building on land. Timber is rendered superior in every respect to the metals; the period of preparation for durable use is short, comparatively; every variety of hue and fragrance may be imparted to the simple board or block. The captain of a Bordeaux vessel, recently returned from the Isle of Bourbon, states that he took out with him specimens of different woods from the collection of Dr. Boucherie, which, though kept constantly in the sea during the whole voyage out and homeward, did not suffer the least deterioration or injury. The French government, having commissioned Dr. Boucherie to operate on public timber, announces its perfect satisfaction with the experiments hitherto made.—*Correspondence of the National Intelligencer.*

THE VALLEY FURNACE.—The new Anthracite Furnace, on the Valley Furnace tract, about seven miles from our borough, was blown in on Friday, the 17th inst., under the superintendence of Mr. Ralston, with complete success, and has continued to work in the most admirable manner ever since. On the first tapping, we understand, grey iron was produced of the best quality. The furnace is 8½ feet across the boshes and has run out about an average of five tons every twenty-four hours. This quantity might be materially increased, but the proprietors, Messrs. Taylor & Co., very properly prefer producing a good iron, in the place of overworking the furnance at the expense of the quality of the article.

This is the fourteenth furnance which has been blown in under the superintendence of Mr. Ralston; and he assures us, that she was blown in with less difficulty, and works with more satisfaction, than any of the others which he has been connected with.

The ore used in this furnance is *exclusively* of this region; and those who may have doubts respecting the quantity and quality of our iron ore can easily have them removed by paying a visit to the above furnance; for we boldly affirm, there is more iron ore in Schuylkill county, and of a quality to produce the very best description of iron, than in any county in Pennsylvania.—*Pottsville Miner's Journal.*

ATTICA AND BUFFALO RAILROAD.—The Attica and Buffalo Railroad Company are proceeding vigorously in the prosecution of this work. The whole road has been placed under contract in a manner that requires each contractor to become a stockholder, receiving his pay half in stock and half in cash. Each contractor having thus an abiding interest in the road, large advances are made towards its completion. The cars will commence running on the 4th of July, 1842, those on the road between this city and Batavia being used for the whole distance to Buffalo, 72 miles.—*Rochester Democrat.*